

In Vitro Effectiveness of Alcohol Based Hand and Skin Disinfectants Against Various Microorganisms

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Abstract

In this study, in order to define how effective alcohol based hand and skin disinfectant is to which concentration against *Staphylococcus aureus* (ATCC 29213), *Escherichia coli* (ATCC 25922), *Pseudomonas aeruginosa* (ATCC 23853), *Candida albicans* (ATCC 10231) strains used for Test microorganisms, final microorganisms was disinfectant into the different concentrations of the disinfectant to be tested by being prepared as 2-5x10⁹ CFU/ml according to the McFarland 5 turbidity of test disinfectant. After disinfectants were activated with microorganisms at previously experimented 30 seconds; 1,5,15 and 30 minute periods, colony counts at 1 ml. Levels were performed by way of cast-cultural plaque method. Consequently, it was determined that 100% concentration of alcohol based skin and hand disinfectant was effective against *Staphylococcus aureus* in 1 minute, while other test microorganisms were effective in 30 seconds.

Key words: Alcohol, Disinfectant, Microorganism

INTRODUCTION

Nowadays, the infections of hospitals that became important day by day are the most important problems of modern medicine. World Health Organization (WHO), inform that in the world, each year more than 190 million people are hospitalized and 5% of them got infection of hospital and therefore they stay in hospital approximately 7 days or more [1,2].

In hospital the first cause of dispersion of high virulence and multiple resistant microorganisms between patients is the dirt of hands. Dirty hands of medical personal are the source of infection at the rate of 20-40% [3].

Biologically, the skin that consist of alive and death layers, is the most important weapon in the defense of body. In the skin there is two genre of bacteria group.

I – Permanent Flora: This microorganism assemblage that is also defined as constant flora, makes stubborn colorizations on skin. Most of these microorganisms are installed at the top layers of the skin and 10-20% of them is installed at deeper layers.

II – Temporary Flora (contamination): These are secretions belonging to patient and microorganisms that are contaminated to the hands of medical personnel by the contact of the contaminated materials and that are placed on the surface of the skin. These microorganisms can not live a long time and can not increase on skin. But they can protect aliveness on the hands so that they contaminate patient to patient. The microorganisms that causes hospital infections belong to this group [4,5].

Washing hands in due form is the most simple method of avoiding from hospital infections. But in spite of hospital infec-

tions, in terms of general public health, washing hands have a very important function. That is, washing hands is actually a medicosocial way of behavior. Therefore, it is possible to evaluate washing hands under 4 titles as: simple social type, hygienic type, hygienic hand disinfection and chirurgical type hand wash [2, 6, 7].

An important points on the subject of washing hands is that the use of gloves. One of the most important points in using glove is that the necessity of washing hands after removing gloves. But, an important problem is the fact that the medical personals are use the gloves only for protect themselves and they can easily bring microorganisms by gloves to other patients and surfaces [8].

In studies that are made in intensive care units, it is founded that *Klebsiella* strains are infected to hospital personnel only after jobs that are not important such as measuring tension or touching patient's hands [9].

Alcohol; is in use since first ages. But the scientifically use of alcohol starts at the end of the years 1800's. In several studies it is proved that the solutions which include 50-70% alcohol are very effective in killing and inhibit bacteria that exist on hands [10].

Especially in units of intensive care, alcohol basis disinfectants are suggested. Alcohol and alcohol basis disinfectants activate strongly in a short time against bacteria and viruses that are in permanent and temporary flora [11].

In our study, it is aimed to investigate the activity of alcohol basis hand and skin disinfectants that are usually used in hospitals against different microorganisms that are seen in

nozochemical infections.

MATERIAL AND METHOD

Material

The hand and skin disinfectant of A Company (Ethyl alcohol with 70% v/v combination) that is used in this study is obtained from medical stores.

Method

Test Microorganisms That Are Used In Trials

Test microorganisms that are used in this study such as *Staphylococcus aureus* (ATCC 29213), *Escherichia coli* (ATCC 25922), *Pseudomonas aeruginosa* (ATCC 23853), *Candida albicans* ATCC (10231) strains are obtained from culture collection of our laboratory. When counting colonies of these microorganisms, for *Staphylococcus aureus*, the Staphylococcus medium 110 (Oxoid), for *Escherichia coli*, Violet Red Bile Agar (Oxoid), for *Pseudomonas aeruginosa*, *Pseudomonas* selective medium (Oxoid) and for *Candida albicans*, Sabouraud-dextrose agar (Oxoid) are used. According to the McFarland 5 blurriness, the final concentration of each strain which are used in this trial will be 2.5×10^9 CFU/ml and they are prepared correspondent with this concentration [12].

Preparation of Neutralization that are used in trials

After the activation of microorganisms of test with disinfectants, for inactivate them, 3% Tween80 + 3% saponin + 0.1% Histidin + 0.1% Sistein combination is used as neutralizateur in the study [13, 14, 15].

Determination of Disinfectants Effects

The commercial form of disinfectant with 70% concentration is accepted 100%, and the solutions are prepared according to this with 50%, 25%, 10% concentrations. In order to determine until which concentration the disinfectant is active, the disinfectant material with different concentration (100%, 50%, 25%, 10%) is distributed into tubes 9 ml. by 9 ml. in each. Then by taking 1 ml of beginning microorganism suspension for each tube they are added to test tubes which include disinfectants with different concentrations (1 ml + 9 ml). Microorganisms are kept waiting in test tubes that includes disinfectant materials, during designed period (1, 5, 15 and 30 minutes). At the end of these contact periods 1 ml are taken from each test tube and added on to neutralizateur materials of 9 ml which are in different test tubes. In 1-5 minutes 0.2 ml of example are taken from each tube and are placed into plaques which includes appropriate medium. After incubation period of 48 hours at 37°C, colonies that are reproduced in appropriate mediums are counted and bacteria numbers in 1 ml. are calculated. At the end of the first minute, the concentration of the disinfectant that cause a decline 5 log and above (the reduction factor is 5 log and above) in the number of microorganism according to the number of microorganism that are treated with disinfectant materials is accepted as effective concentration. Besides, it is confirmed that the neutralizateur materials don't have a deterrent effect on the reproduction of microorganisms and don't cause decline in the number of microorganisms. And also is confirmed that it inactivate the effect of disinfectant material by the experiments [9, 10, 11].

RESULTS AND DISCUSSION

The results of disinfectant A against test microorganisms are given in table 1-2-3-4.

Table 1: *S.aureus*'s number of colony in 1 ml after the time limit (CFU/ml) In different concentrations treated with A disinfectant's solutions.

Cons. (%)	Effect duration(minute)							
	30 mn	RF 1	mn	RF 5	mn	RF 1	5mn	RF
100	4.4×10^4	3.96 -			-	-		
50	$>10^5$	<3.60			-	-		
25	$>10^6$	<2.60	$>10^6$	<2.60	$>10^6$	<2.60	$>10^6$	<2.60
10	$>10^6$	<2.20	$>10^6$	<2.60	$>10^6$	<2.60	$>10^6$	<2.60

-: microorganism did not multiply initial suspension: 4×10^9 CFU/mL
RF: log reduction factor final con. in the disinfectant: 3×10^8 CFU/mL (8.60 log CFU/ml)

Table 2: *E.coli*'s number of colony in 1 ml after the time limit (CFU/ml) In different concentrations treated with A disinfectant's solutions.

Cons. (%)	Effect duration(minute)							
	30 mn	RF 1	mn	RF 5	mn	RF 1	5mn	RF
100	-	-			-	-		
50 -			-	-			-	
25	$>10^6$	<2.43	$>10^6$	<2.43	$>10^5$	<3.43	1.65×10^3	5.22
10	$>10^6$	<2.43	$>10^6$	<2.43	$>10^6$	<2.43	$>10^6$	<2.43

-: microorganism did not multiply initial suspension: 2.75×10^9 CFU/mL
RF: log reduction factor final con. in the disinfectant : 2.75×10^8 CFU/mL (8.43 log CFU/ml)

Table 3: *P.aeruginosa*'s number of colony in 1 ml after the time limit (CFU/ml) In different concentrations treated with A disinfectant's solutions.

Cons. (%)	Effect duration(minute)							
	30 sn	RF 1	dk	RF 5	dk	RF 1	5dk	RF
100	-	-			-	-		
50 -			-	-			-	
25	$>10^6$	<2.69	$>10^6$	<2.69	$>10^6$	<2.69	$>10^6$	<2.69
10	$>10^6$	<2.69	$>10^6$	<2.69	$>10^6$	<2.69	$>10^6$	<2.69

-: microorganism did not multiply initial suspension: 5×10^9 CFU/mL
RF: log reduction factor final con. in the disinfectant: 5×10^8 CFU/mL (8.69 log CFU/ml)

Table 4: *C.albicans*'s number of colony in 1 ml after the time limit (CFU/ml) In different concentrations treated with A disinfectant's solutions.

Cons. (%)	Effect duration (minute)							
	1mn	RF 5	mn R	F	15mn R	F	30mn R	F
10-	-				-	-		
5	--				-	-		
2,5	--				-	-		
1	--				-	-		
0,5	--				-	-		
0,1	1,1x10 ⁵	2,43 2	,2x10 ⁴	3,13 1	,1x10 ⁵	2,43 4	,1x10 ⁴	2,86
0,05 >	105 <	2,47 >	10 ³	<2,47	>10 ⁵	<2,47	>10 ⁴	<2,47

-: microorganism did not multiply initial suspension: 2.25×10^8 CFU/mL

RF: log reduction factor final con. in the disinfectant: 2.25×10^7 CFU/mL (7.35 log CFU/)

%100 concentration of disinfectant A is defined effectively in 30 seconds.

In a study that is made with *S.aereus* and *Paeruginosa*, it is found that, the septoderm spray and alcohol basis hand antiseptics are more effective than prosavon and predex HS 550 [16].

Alcohols, according to all antiseptics, have perfect activity and fast bactericidal effects. In addition, they have advantages such as fast usable and fast evaporation. All bacteria, have optimal antimicrobial spectrum against viruses and fungi which have clinical importance [17, 18, 19, 20]. The comparison of ethanol with different disinfectant and disinfectant of alcohol are made and the advantages are reported [21].

In conclusion, we think that in choosing hand disinfectants it is important to select disinfectants which are effective in a little while to vegetative forms of pathogen bacteria and which protect hands when considering the development of resistance of microorganisms.

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